REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
07-04-2011	Master of Military Studies Research Paper	September 2010 - April 2011

4. TITLE AND SUBTITLE
From Good to Great: Creating a Fires-Centric VMU Culture

5a. CONTRACT NUMBER
N/A

5b. GRANT NUMBER
N/A

5c. PROGRAM ELEMENT NUMBER
N/A

6. AUTHOR(S)
Major Kain C. Anderson, USMC

5d. PROJECT NUMBER
N/A

5e. TASK NUMBER
N/A

5f. WORK UNIT NUMBER
N/A

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
USMC Command and Staff College
Marine Corps University
2076 South Street
Quantico, VA 22134-5068

8. PERFORMING ORGANIZATION REPORT NUMBER
N/A

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
N/A

10. SPONSOR/MONITOR'S ACRONYM(S)
N/A

11. SPONSORING/MONITORING AGENCY REPORT NUMBER
N/A

12. DISTRIBUTION AVAILABILITY STATEMENT
Unlimited

13. SUPPLEMENTARY NOTES
N/A

14. ABSTRACT
Marine VMU Squadrons are on the precipice of history with the forthcoming introduction of precision munitions. While Marine leaders recognize that VMUs need consistent advocacy, VMU fires integration knowledge is equally important. An unmanned aerial systems aircraft commander primary military occupation specialty transition board convenes in the summer of 2011. Eight aviators with fighter and/or attack backgrounds must permanently transition to VMU squadrons. These officers will lead VMU fires integration into the Marine Corps offensive air support architecture.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE	UU	24	Marine Corps University / Command and Staff College
Unclass	Unclass	Unclass			19b. TELEPONE NUMBER *(Include area code)* (703) 784-3330 (Admin Office)

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

From Good to Great: Creating a Fires-Centric VMU Culture

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENT FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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United States Marine Corps

AY 10-11

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Approved: _____
Date: 4 MAY 2011

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Approved: _____
Date: 4 May 2011

EXECUTIVE SUMMARY

Title: From Good to Great: Creating a Fires-Centric VMU Culture

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Thesis: Marine unmanned squadrons (VMU) are on the precipice of history with the forthcoming introduction of precision munitions to RQ-7B Shadow UAS. Marine leaders recognize that VMUs need consistent advocacy. An unmanned aerial systems aircraft commander primary military occupation specialty transition board convenes in the summer of 2011. Eight aviators with fighter and/or attack backgrounds must permanently transition to VMU squadrons. These officers will lead VMU fires integration into the Marine Corps offensive air support architecture.

Discussion: Over the past nine years the Air Force adapted personnel policies as it strove to merge manned and unmanned aviation platforms. Unmanned aerial systems (UAS) existed in a vacuum until weaponized. Once armed, experienced fighter/bomber aircrew were required to ensure proper employment of UAS ordnance. Initially, the Air Force involuntarily assigned pilots to UAS squadrons. At one point 75% of Predator pilots had fighter/bomber backgrounds. Reduced tour lengths, choice of follow-on assignment, and aviation career incentive pay changes increased pilot volunteer rates. Although Air Force and Marine Corps culture is different at the organizational level, their pilot culture is remarkably similar. The Marine Corps will be challenged by the need to assign highly qualified aviation fires integrators to VMU squadrons. The Air Force broke its manpower mold in order to properly train and man Predator squadrons. In order to properly train and man VMU squadrons the Marine Corps must follow the Air Force's lead and ensure eminently qualified aviators are assigned to VMU squadrons.

Marine aviation fires integrators exist along a spectrum from the non-combat arms TBS graduate (classified as "level one") to the FAC(A) with a ground Forward Air Controller tour (level five). The Marine Corps must assign pilots and weapon system operators (WSO) to VMU squadrons who come from the F/A-18, AV-8B, or AH/UH-1 communities. These aviators have unique aviation fires integration skills. They will conduct VMU fires training and create a "fires-centric" culture. VMUs present unique training challenges. Initial training is outsourced to the Army, and the laser designator is not utilized at the Army school. Marine VMUs do not have a dedicated training squadron. VMU officers at Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) do not have aviation fires integration backgrounds. Marine leaders cannot "cast the net widely" and expect to "fix it with training" in the case of armed UAS. In this case there is no substitute for knowledgeable leaders who can set the conditions for success.

Sufficient numbers of qualified personnel exist to fill VMU fires subject matter expertise requirements. Marine F/A-18 weapon system operators (WSO) are the obvious first answer. Junior WSO majors should be targeted for transition. The Marine Corps is 128% of grade adjusted recapitulation (GAR) for WSOs. Other communities can provide manpower to VMU squadrons as well. Most platforms have similar overages in Majors due to the need for less mid-level leadership (the grade shape "pyramid"). The challenge is to incentivize the target population correctly. It is unlikely that captains and junior majors from the strike community will volunteer for transition to VMU squadrons.

Conclusion: Solutions ranging from low to high impact are available. At the low impact end of the spectrum, the summer 2011 transition board must set precepts to ensure that eight aviators with strike backgrounds transition to unmanned aerial systems aircraft commander. Follow-on transition boards should select only aviators with the 7502 Forward Air Controller secondary MOS. The medium-impact course of action calls for delaying the summer 2011 transition board until Marine UAS are armed. Marines generally have a higher regard for platforms with kinetic effects. Once UAS begin dropping ordnance all eyes will turn in their direction, and scrutiny will follow. Armed UAS are several years away, but a fires-centric culture must be established now in order to set the conditions for success. The timing of the first transition board is unfortunate with respect to attracting the target audience. Finally, Marine leaders may need to involuntarily assign personnel to permanent duty as UAS aircraft commanders. The Air Force made a difficult, but correct choice in this matter. If Marine leaders enact a similar plan, those aviators involuntarily assigned must receive substantial incentives. Organic weaponized persistent stare capability is just a few years away for the MAGTF. The opportunity for increased synergy is commensurate to the friction that will result if VMU personnel cannot properly integrate fires. The stakes are deceptively high, and now is the time to act decisively. Assigning expert aviation fires integrators to the unmanned systems aircraft commander MOS is the first step toward good to great VMU squadrons.

ACKNOWLEDGMENTS

I am indebted to my peers at MAWTS-1. During my time there I learned far more than I was able to teach. I am grateful that Marines from the UAS, Air Officer, and TACAIR divisions are willing to "stand up" and have their voice heard in the quest to integrate UAS fires into the MAGTF. The faculty and supporting staff at Marine Corps University are second to none. They go about their business with humility, and lead by example. LtCol Monroe, Drs. Robert Bruce and Paul Gelpi paid particular attention to my development, one could not hope for better mentorship. I am thankful to have the support of my mother, my wife and her family. Without their team effort my service to this country would not be possible. To my children: may you stay forever young at heart, and fight for righteousness.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

Preface

I approach Unmanned Aerial Systems (UAS) from the users perspective. As a Forward Air Controller with India Company, Third Battalion, Fifth Marines in Fallujah during operation AL-FAJR in November, 2004 I had two Marines from the supporting VMU squadron attached to my tactical air control party (TACP). They were there to assist me with providing close air support (CAS) fires by means of their man packable receiving station. This hardened "Buck Rodgers-like" backpack was heavy, non-intuitive, and fickle. At times it seemed that the most advantageous aspect about the Pioneer receiving station was the high mobility multipurpose wheeled vehicle (HMMWV) that the two Marines brought to transport their weighty pack between engagements. Despite its many shortcomings the man packable receiving station was useful during operation AL-FAJR. Not only could it receive RQ-2A Pioneer video, but it also displayed video from USMC AV-8B Harriers equipped with LITENING targeting pods that had been modified with Pioneer transmitters. Several years and one more deployment to Iraq later I served in the air officer department at Marine Aviation Weapons and Tactics Squadron-1 (MAWTS-1). In this capacity I volunteered for the role of "UAS subject matter expert". From this perspective I strove to integrate UAS into CAS and Strike Coordination and Reconnaissance (SCAR) missions. I participated in the evolution of UAS into the USMC fires chain. With the news that Pioneer's replacement, the RQ-7 Shadow, would be equipped with an infrared marker and laser designator Marine UAS took a dramatic step from passive observation to physically effecting the battlefield. Current efforts to add weapons to the RQ-7B Shadow are the final step in the transformation of VMU squadrons from intelligence gatherers to lethal warriors.

While I embrace this transformation my experience integrating UAS into the fires chain gives

me pause. Delivering fires from an aviation platform is demanding. It requires in-depth knowledge of one's platform and weapons. All personnel delivering aviation ordnance have an understanding of the broader fires chain that leads to successful target prosecution amidst battlefield chaos. Despite best efforts UAS crew all too often stumbled in basic fires integration tasks from airspace management to proficiency in CAS vernacular. Foibles are to be expected given the past observation-only role of VMU squadrons. Manpower policy assigns officers with a variety of military occupational specialty (MOS) backgrounds, and does so in an ad-hoc manner. VMU squadron culture is ill prepared to conduct offensive air support operations.

Fortunately the Marine Corps is creating a new primary MOS career field to address inconsistent officer leadership in VMU squadrons. As VMU squadrons transition from imagery collection and branch out into all six functions of Marine Aviation this process will ensure consistent leadership. The first VMU Unmanned Aircraft Mission Commander (UAC) transition board begins in the summer of 201. Transitioning the appropriate number of officers with aviation fires integration experience will ensure that the Marine Corps takes today's good VMU and sets the conditions for great VMU success in the next 20 years.

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Introduction

The past ten years wrought rapid change to Unmanned Aerial Systems (UAS) employment. [1] More than any other development, the addition of weapons to UAS complicates the already difficult task of properly manning and training a rapidly growing career field in the Department of Defense. The Air Force first operated weaponized UAS in 2001.[2] The Army fielded its first general support weaponized UAS under a Quick Reaction Capability in Summer 2008.[3] As the last service to field a weaponized UAS, Marines plan to arm RQ-7B Shadow with small precision munitions sometime in the fiscal year 2012 (FY 12) to FY 14 timeframe. The distinct missions, equipment, and cultures of the, Air Force and Marine Corps drive each Service's policy governing personnel management, training, and employment of weaponized UAS. Marine officers supervise enlisted UAS operators while Air Force pilots "fly" Predator and Reaper. Integrating Predator and Reaper UAS into Air Force culture created friction in an organization that prides itself on the bravery of pilots. Marine aviators are similar to their Air Force counterparts. All Marines strive to be at the "tip of the spear," not clicking a mouse miles away from combat operations. As technology evolves the Marine Corps must integrate UAS fires into Marine Air Ground Task Force (MAGTF) offensive air support (OAS) operations. The Air force already tread the ground Marine unmanned squadrons (VMU) are preparing to cross. The Marine Corps can apply lessons learned from the evolution of Air Force UAS from passive intelligence collection to kinetic attack as the Corps strives to create a fires-centric VMU culture.

In some respects the Marine Corps is better positioned to properly man UAS squadrons than the Air Force. The Air Force can no longer sustain its policy of manning UAS exclusively with rated pilots.[4] Defense Secretary Gates' mandate for 65 UAS combat orbits made the Air Force UAS manning policy unsustainable.[5] The Air Force is now studying the feasibility of a UAS operator career field with a unique training pipeline. Due to the Marines' smaller size and flexibility the Corps already decided to create a new UAS aircraft commander officer MOS. The first transition board will select twelve Marine aviators for permanent transition to UAS aircraft commander (UAC) in summer 2011. Headquarters Marine Corps (HQ USMC) sponsored two studies during 2009 and 2010 that address all aspects of VMU operations, maintenance, and manpower.[6] One study is complete and supported the May 2010 decision to create the dedicated UAS aircraft commander MOS. The second study is still in progress. It addresses the program of instruction for newly minted 2nd Lieutenants with the UAS aircraft commander MOS. The second study will develop a detailed timeline that slowly increases the number of UAS-only officers from fiscal year 2012 until the first UAS-only officer takes command of a VMU in 2026. In the near term the Marine Corps will continue to augment VMU operations with Marine aviators. Fires experience as it relates to military occupation specialty (MOS) background of UAC officers is the focus of this paper. Because this is a nuanced discussion it is often overlooked in the UAS manpower debate. Also, many of the personnel with firsthand experience in the weaponized UAS field are in the operational forces. They do not have the luxury of envisioning the negative impact that poorly trained UAS crews will have on MAGTF fires synergy. The introduction of weaponized UAS into VMU squadrons will demonstrate the requirement for UAC with aviation fires integration experience; however, on the job training

will not compensate for inexperience, especially in combat. Consequently, the challenge for Marine tactical aviation is to apply Air Force lessons learned to Marine culture. Marines must maintain a clear vision of organic weaponized UAS that provides offensive air support to the MAGTF.

Air Force Remotely Piloted Vehicles- A Pilot In the Loop Plateau?

The impact of the Air Force's pilot culture on its UAS operations cannot be understated. The re-adoption of the term "remotely piloted aircraft" (RPA) in reference to Air Force UAS is the most recent evidence of the cultural conflict that UAS impose on Air Force traditions. Lieutenant Colonel James Dawkins summarizes the impact of UAS on Air Force culture in a thesis titled, "Unmanned Combat Aerial Vehicles: Examining the Political, Moral, and Social Implications."[7] He states:

> The culture of the Air Force flying community itself added to feelings of inadequacy [in relation to UAS careers]. It is a culture where operators identify themselves with their respective airframes more so than their occupation. If you ask an aviator what he does in the Air Force, he is likely to answer with "I'm a bomber pilot" or "I'm a Viper (F-16) pilot." Some even consider themselves pilots first and Air Force officers second.[8] But ask a Predator pilot what he flies and he's likely to say "I'm a former Viper (Eagle, C-5, B-1) pilot, but I fly Predators now."[9]

A deep cultural aversion to unmanned operations pervades the Air Force's early treatment of unmanned operations, even in the face of unprecedented battlefield utility. Marine and Air Force culture is vastly different. The former focuses air power on supporting the infantry, while the latter views airpower as a tool of warfare unto itself. Most Marine aviators would answer the question posed above with something akin to "I'm a Marine first, and a pilot second." Even though Marine aviators' primary allegiance is to the Corps, they still identify strongly with their

aviation heritage. Consequently, Marine aviators would in general prefer a flying billet to a non-flying billet if offered their choice of assignments. Other organizational factors that affect a pilot's career choices will be discussed in section three. The issue is more complex than simple identification with Marine aviation's heritage, although the loss of esprit de corps associated with service away from the Marine aircraft wing plays an important role in a pilot's decision to seek "diverse" assignments elsewhere. Although Marine and Air Force cultures are different on a macro scale, when it comes to individual pilot preferences, the two are remarkably similar.

The roots of the Air Force's decision to treat UAS as aircraft date back to the end of Predator's advanced concept technology demonstration (ACTD) phase. During the Predator's 30 month ACTD the Army was largely responsible for operating the system. By the end of this period the Air Force was convinced that predator operations required aeronautical skills beyond those demonstrated by the Army.[10] Due to the high mishap rate that Predator experienced during its ACTD phase, Air Force leaders were convinced that only rated pilots could bring the mishap rate down to acceptable levels.

Air Force leaders ensured the right pilots were assigned to Predator squadrons by involuntary assignment. General Fogleman's philosophy that "If this [Predator] program fails, it won't be because of our pilots" summarizes Air Force policy during the early years of Predator operations.[11] Air Force leaders realized that only experienced pilots could ensure integration of UAS into Air Force battle space. In subsequent years the Air Force made several adjustments to increase the volunteer rate for Predator assignments. Tour lengths were decreased from three years to two, and pilots were given their choice of follow-on geographic preference. Volunteer rates subsequently increased, resulting in higher quality personnel.[12] The platform's

contribution to overseas contingency operations and its new air-to-ground strike capability also increased the palpability of Predator tours. One highly accomplished Air Force F-16 pilot who is a graduate of the School of Advanced Air and Space Studies stated that he had been trying to do a UAS tour for several years.[13] He is still the exception rather than the rule. Although many pilots flying Predator are not volunteers, Air Force navigators in Predator squadrons are all volunteers, and display a high level of motivation. The fact that navigators serving as Predator pilots must obtain FAA commercial/instrument licenses on their own time and at their own expense partially accounts for their high level of motivation. A former B-1 navigator noted that the Predator job attracts navigators because it allows for greater responsibility. Rather than serving a support function on a crew they can act as an aircraft commander.[14] The Air Force ensured adequate numbers of quality personnel in UAS squadrons by implementing involuntary assignments. As personnel policies evolved and Predator gained renown for battlefield utility the pilot volunteer rate increased. Changing UAS tour lengths, offering pilots their choice of follow-on tours, and the utility of weaponized UAS produced small changes to Predator pilot volunteer rates. In order to further reduce the stigma of UAS service, the Air Force aligned aviation career incentive pay (ACIP) between manned and unmanned pilots.

Pilots assigned to Predator in the mid 1990's did not accumulate credit for operational flying duty. If a pilot does not accrue enough flying duty credit he is at risk of losing ACIP pay. Air Force ACIP policy served as a disincentive for pilots to volunteer for Predator service, and decreased morale of those in Predator assignments. Predator pilots wondered how the Air Force could subject them to check rides that were equivalent to manned aircraft, thus subjecting them to the threat of a flight-evaluation board and not award flight gate credit.[15] The

decision not to award operational flying duty credit to Predator pilots was based upon a Judge Advocate General (JAG) opinion from 1996 that determined physical flight in an aircraft was necessary to meet the intent of the law. The 1996 opinion was re-evaluated by the Air Force General Council in 2002, resulting in the conclusion that "the current statute is a quarter century old and has not kept pace with technological advances...."[16] The 2002 decision prompted the Air Force Secretary to allow ACIP for Predator pilots, stating in his reasoning that "basic flying skills are maintained in the performance of [UAS] duties."[17] The ACIP policy adjustment alleviated angst among Predator pilots and served to further integrate UAS into Air Force culture.

The ratio of Air Force pilots from the fighter and bomber combat air force (CAF) to those from airlift/tanker mobility air force (MAF) backgrounds illustrates the impact of weaponization on personnel policy. By 2001 Predator assignments were equally split between CAF and MAF pilots. Arming Predator with hellfire missiles required a personnel adjustment. Weapons employment required many skills that airlift/tanker pilots had never acquired. Beyond the practical considerations of weapon system and fires integration knowledge, Law of Armed Conflict and rules of engagement highlighted the need to assign personnel familiar with these issues. With these considerations in mind, Air Force policy changed to assign 75% CAF and 25% MAF pilots to Predator squadrons to address these issues.[18] Predator squadrons rely upon the expertise of CAF pilots during high-tempo combat operations. The policy of assigning combat experienced pilots to UAS squadrons also allows a shortened training timeline-- typically only three months long.[19] Now the Air Force is reconsidering the validity of its "pilot only" approach

to Predator and Reaper (Group 4 and 5, see Figure 1) UAS operations since the 65 UAS combat orbit requirement overwhelmed this manpower policy.

The USAF 2010 UAS flight plan notes that the Air Force has a requirement for nearly 15,000 UAS Airmen.[20] In 2009 the Air Force was short nearly 100 Group 4 and 5 pilots. In order to fill this gap, the Air Force is testing a completely new program with the goal to:

> ...develop a UAS pilot career field with specialized UAS training distinct from current manned aircraft pilot training. A non-traditional pilot training path creates an additional source of UAS operators and relieves the UAS manpower burden on the current Specialized Undergraduate Pilot Training (SUPT) pipeline. Furthermore, training can be specifically tailored to the needs of the UAS community.[21] The USAF must immediately initiate positive actions at all levels to establish a long term, sustainable, normalized UAS culture.[22]

After fifteen years of Predator operations, nine of which include ordnance employment, the Air Force is finally establishing a unique career path for UAS "pilots." Air Force planning documents indicate that leaders are concerned about the tactical proficiency of inexperienced UAS operators. The 2009 flight plan states "The essence of combat operations (including fog and friction of war) must be designed into scenarios in order to provide the UAS crew with the skills, knowledge, mental tools, and confidence to succeed in time-compressed and uncertain environments."[23] Clearly the Air Force expects its UAS operators to think independently, integrate with other fixed wing manned aviation assets, and deliver weapons in close proximity to friendly troops.

The evolution of UAS technology will continue to challenge Air Force culture and personnel policy. The Army's newest armed UAS, the MQ-1C Gray Eagle, features a ground control station (GCS) that operates entirely via keyboard and mouse. The Air Force Predator and Reaper GCSs require more hands-on flying skills from pilots. If the Air Force purchases a

more "advanced" GCS similar to Gray Eagle, can one reasonably conclude that basic flying skills are maintained? The answer is yes, if a pilot's ability to integrate predator with manned aircraft in CAS operations takes precedent over "stick and rudder" skills. Pilots with fighter/bomber experience may be required today because of the aviation fires integration skills developed in manned platforms. In the future, however, UAS operators will develop a unique skillset, including UAS fires integration. "Pilots" will no longer be required.

The weaponization of Predator challenges Air Force culture as it struggles to manage UAS evolution from passive observation to kinetic attack. Air Force leaders implemented changes that attempt to merge manned and unmanned manpower policies as well as make UAS service more palatable. Monetary incentives are used to attract pilots to UAS service. Shortened tour lengths and choice of follow-on assignments also increased the pilot volunteer rate. As Predator and Reaper contribute to contingency operations more Air Force pilots are attracted to UAS service. Most importantly, the Air Force attempted to solve its fires knowledge deficit with rated pilots from fighter and bomber backgrounds. The Air Force does not compromise on providing expert personnel with weapon employment experience to train and maintain standardization. Similarly, the Marine Corps is struggling to integrate UAS into the MAGTF fires structure. The Marine Corps must solve UAS fires integration in the same manner as the Air Force: ensure aviation fires integration expertise is embedded in each VMU squadron.

Marine UAS: On the Precipice of History

Currently Marine UAS fill four of the six functions of Marine Aviation, and are poised to expand with the addition of weapons to the RQ-7B Shadow and the development of electronic

warfare payloads. Despite the utility of Marine UAS over the past 26 years, their capabilities are still misunderstood. Even after the 2010 Marjeh offensive in Operation Enduring Freedom it is apparent that the modern capabilities of UAS are under-utilized.[24] Evidence suggests that the Marine Corps is experiencing the same growing pains that the Air Force experienced with its weaponized unmanned aerial systems (UAS). Major Joe Bertagna's article in the Marine Corps Gazette entitled "UAS: It's Time to Get Serious" notes that UAS equipped with laser designators are "...not just for intelligence, surveillance, and reconnaissance anymore. That line of thinking will lead to utilization of about 10 percent of the capability of our organic UASs. Fifty percent of the mission essential task list for the Marine unmanned squadron (VMU) is related to fires and fires coordination."[25] Marine UAS are playing an offensive role on the battlefield with their laser designator. Who is training our VMU operators on the intricacies of close air support (CAS) operations?

Marine UAS follow the Air Force evolution from passive reconnaissance to offensive combat operations. It is no surprise that VMUs are populated with a variety of officers from various military occupational specialties (MOS) with varying levels of tactical competence. Historically VMUs were manned according to the data displayed in table 1.

Community	Representative MOS	Historical Percentage of VMU Officers
H-1	7565 (AH-1W Pilot)	13%
Assault Support	7532 (V-22 Pilot)	37%
EW	7588 (EA-6B ECMO)	3%
Strike	7523 (FA-18 Pilot)	13%
C2	7210 (Air Defense Control Officer)	33%

Table 1. VMU officer source communities[26]

Note that unit staffing goals are derived from a table of organization (T.O.) that lists the number of officers from each community that should be assigned to VMU squadrons. Though the T.O. provides baseline guidance, actual officer manning is determined through the "B" billet assignment process wherein VMU officer requirements are published to USMC aircraft wings. Marine Aircraft Groups (MAGs) nominate personnel for assignment to VMUs. The data in table one indicates that 26% of officers assigned to VMUs have CAS backgrounds (H-1 and fixed-wing strike communities).[27]

The number of electronic warfare (EW) officers assigned to VMU squadrons is relatively low at 3%. EW officers have an understanding of "fires" in a theoretical sense, as Marine Corps doctrine includes EW as a subset of fires. Whether or not an EW officer understands the intricacies of CAS execution depends upon how far he progressed in his primary MOS training before his VMU assignment (see Figure 3 for average time in service prior to arrival at VMU). Since an officer's assignment to a VMU squadron is by definition outside his primary MOS it is unlikely that many VMU EW officers at the captain or major levels attend the Marine Aviation Weapons and Tactics Instructor course (WTI) prior to serving in a VMU.[28] Thus 84% of officers assigned to VMU squadrons have no background in CAS training or execution. C2 officers (72XX MOSs) are further removed from aviation tactics given that their primary MOSs are dedicated to aviation support in the form of air traffic control (ATC), low altitude air defense (LAAD), air support control (direct air support center, DASC), and air defense control (tactical air control center, TACC). 72XX officers possess a basic level of fires integration knowledge imparted to them at TBS and during fleet tours. Familiarity with USMC offensive air support doctrine and aviation fires integration is not a part of their primary MOS duties. Of the five categories of

officers assigned to VMU squadrons (Table 1), the 26% of aviators from the strike and H-1 communities are the target audience for transition to the UAC primary MOS. By virtue of normal progression through their primary MOS training these officers are best equipped to lead the VMU transition from passive intelligence collection to kinetic attack in support of Marine air-ground task force (MAGTF) objectives.

The Marine Corps faces cultural challenges in assigning aviators with fires backgrounds to serve in VMU squadrons. Marine pilots share some of the Air Force's cultural aversion to UAS assignments. The June 2009 Center for Naval Analysis (CNA) study sponsored by HQ USMC aviation branch attempted to analyze the perception that:

- Aviators do not like being assigned to the VMUs; however, 72XX officers do.
- Company grade aviators actively seek reassignment out of the VMUs before the end of their 3-year tours.
- Aviators assigned to the VMU have been placed there because they are not the best aviators.[29]

Bullet one is subjective in nature. However, bullet two has positive confirmation (see Figure 2). Figure 3 offers anecdotal evidence that regardless of aircraft type, pilots prefer flying to VMU service. The fact that pilots lose all of their qualifications after eighteen months without flying is also an organizational bias against service outside their primary MOS. Bullet three is also a subjective statement. There are many factors involved in how an aviator is assigned to VMU service, including career timing, geographic preference, and a desire to avoid front-line combat duty that a forward air controller (FAC) assignment entails. Figure 4 indicates aviators with a history of VMU service are less likely to be promoted to lieutenant colonel. Furthermore, two-thirds of pilots serving in VMU squadrons either went to other supporting establishment billets (not back to their primary MOS flying jobs), schools, or ended their service with the Marine

Corps.[30] The above evidence suggests that the Marine Corps is facing the same cultural paradox as the Air Force: at the same time Marine UAS are moving toward offensive operations, aviators with fires integration experience are not inclined to serve in UAS squadrons.

What constitutes "fires integration" experience in Marine vernacular? Marine Corps Warfighting Publication (MCWP) 3-16 *Fire Support Coordination in the Ground Combat Element* states "Integrating fire support with the scheme of maneuver requires precise arrangement of coordinated activities in time, space, and purpose to produce the most effective fires."[31] In practical terms this means that VMUs must integrate the RQ-7B Shadow UAS weapon system into the ground combat element (GCE) scheme of maneuver, and into a dynamic aerial environment. The essence of Marine combat power is summarized by then Major General Blackman who wrote, "The signature characteristics of the Marine Corps are its expeditionary culture and core competency as a total force in readiness. We achieve these characteristics through an inherent flexibility and ability to task organize and fight as an integrated combined arms team."[32] General Blackman's use of the term "inherent flexibility" is important. Those two words represent the Marine Corps critical capability with respect to applying combined arms in maneuver warfare. All Marines must be experts on their weapon systems and understand how their actions impact other warfighting functions in order to realize the level of flexibility General Blackman envisions. Relevant training and experience are the critical vulnerabilities of "inherent flexibility." Senior Marine leaders assume a baseline level of competency in combined arms integration. The vast majority of officers in today's VMU lack the relevant training and experience to integrate weaponized UAS with either the GCE scheme of maneuver, or the aviation combat element's offensive air support (OAS) operations. The space where aviation

fires and the GCE scheme of maneuver interact requires careful attention to detail. The Marine Corps has several organizational elements in place to facilitate this interaction. From division, regiment, and battalion fire support coordination centers to tactical air control parties (TACP), forward air controllers airborne (FAC(A)), and direct air support centers (DASC) the Marine Corps dedicates a tremendous amount of resources to safe and effective delivery of aviation fires in support of the GCE. All of these agencies are useless without the people who understand fires integration. What is an offensive air support fires "integrator"?

In order to answer the above question, it is necessary to establish boundaries. First, only Marine Captains and Majors are considered because they are the target of the summer 2011 UAC transition board. Next, in order to define broad bases of experience, MOS backgrounds are used to categorize levels of fires integration experience. Just as the Air Force leveraged CAF pilots to fill 75% of its Predator seats after weponization, the Marine Corps must leverage the aviation fires integration experience of its aviators. However, not all pilots or Marine officers in general have equal levels of fires integration experience. Table 2 offers a hierarchy of fires integration experience by MOS background.

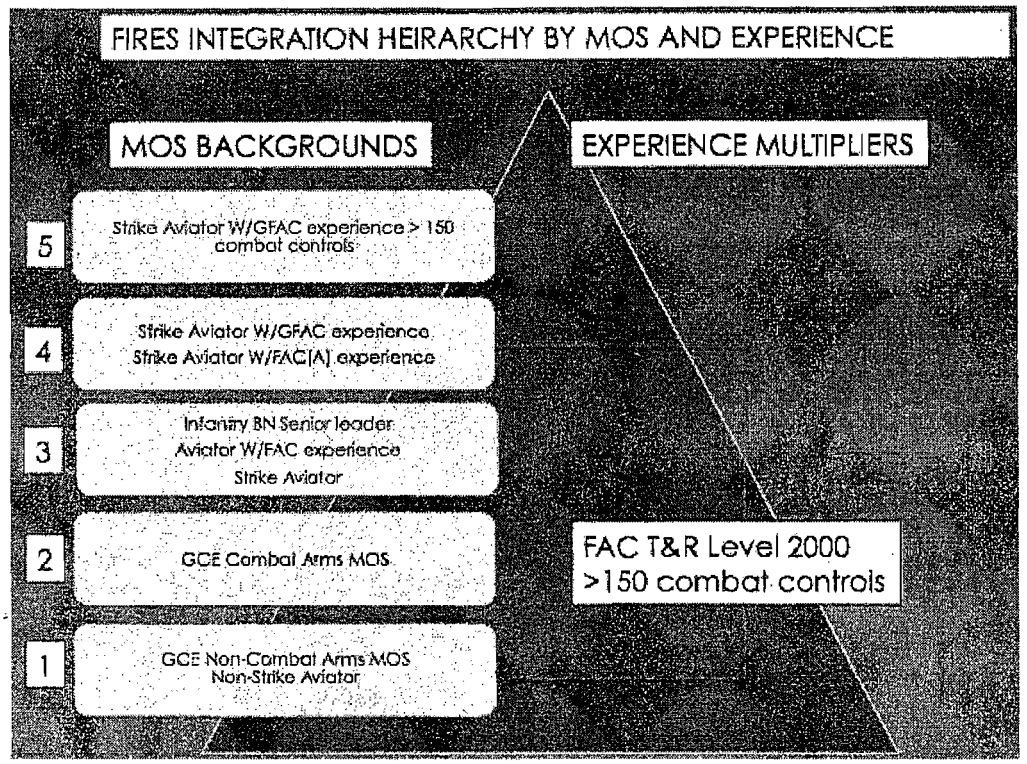

Table 2- Fires Integration Hierarchy by MOS and Experience. (Source: Author)

Level one consists of MOSs with the least amount of fires integration expertise such as 72XX officers and non-strike aviators. By nature of their training and function in the Fleet Marine Force (FMF) these officers are only responsible for the level of fires integration training they received at the basic school. Level two consists solely of ground combat element (GCE) combat arms MOSs such as infantry and artillery. The assumption is that a level two fires integrator is a captain on his first FMF tour. This officer completed infantry officers basic course but has not yet served in a battalion level fires integration billet such as weapons company commander, tactical air control party (TACP) team leader, or in the battalion FSCC. Level three is composed of officers from several backgrounds; it is here that experience begins to level the playing field between MOSs. Strike aviators enter the scale at level 3. AH/UH-1, AV-8B, and F/A-18 aviators learn the basics of fires integration and CAS execution at their MOS producing schools. Fires knowledge is continuously developed during their FMF service. A non-strike aviator is included

in level three if he received the 7502 forward air controller secondary MOS designation. Experienced infantry leaders such as operations officers, weapons platoon commanders, executive officers, and commanding officers have two to three FMF tours. They have a greater understanding of fires integration, though they may lack specific knowledge about aviation-specific constraints. Level four combines a strike aviator's knowledge with the experience of a ground FAC tour in an infantry battalion. FAC(A) aircrews are also included in Level four. Finally, level five represents the MAGTF's most experienced aviation fires integrator: an aviator with a strike background, and ground FAC experience consisting of over 150 combat controls. Level five integrators are rare commodities. Typically they have served as a MAWTS-1 air officer department instructor, completed an intense combat FAC tour, or had a non-standard career consisting of multiple ground FAC tours as a captain and major. The Marine Corps has several level five integrators, a few serving at MAWTS-1, and in naval special warfare (SEAL team) joint billets. Although subjective in nature, this hierarchy is grounded in Marine Corps military occupational specialty (MOS) training and readiness manuals. It acknowledges that experience is an important component of MAGTF fires integration. Since experience plays such an important role in fires employment, it is necessary to discuss how "experience multipliers" allow a non-strike aviator to serve at a fires integration level beyond his baseline MOS training.

Captain Victor is an experienced aviation fires integrator. A CH-53 pilot by MOS training, he was medically grounded and volunteered for a ground FAC tour during his recovery. As a former force reconnaissance enlisted Marine, Captain Victor knew he wanted to serve as a FAC, and his temporary medical grounding allowed him an early opportunity. With the consent of his squadron commanding officer he received a waiver to leave the cockpit early and attend TACP

School. He then completed a FAC tour with a Marine infantry battalion during Operation Iraqi Freedom. Upon return to his squadron Captain Victor faced a daunting career decision. Though he had the support of his squadron leadership, Captain Victor realized that after a year away from flying he was well behind his peers in terms of pilot skill progression. He decided to take the Navy up on a unique opportunity to serve with NSW development group 6 (SEAL Team 6), hoping to parlay his fires integration experience into follow-on opportunities within the Marine Corps. Captain Victor's fires integration resume includes over 570 controls and service with one of the U.S. military's most elite fighting units. Captain Victor also served as an augment MAWTS-1 air officer instructor and offered input to the Marine Corps TACP training and readiness manual (T&R manual). As noted in table 2, a non-strike aviator like Captain Victor can jump from a level 1 integrator to level four given enough fires integration practical application experience. Note that even with his vast experience Captain Victor does not attain level five. He too, acknowledges that there is no substitute for experience delivering fires from a strike platform in the air combined with the "boots in the dirt" perspective of a ground FAC.[33]

The data in Table 2 is misleading in one respect: A level 1 non-combat arms ground officer is depicted as having the same opportunity to use "experience multipliers" to jump up the scale like a non-strike aviator. In reality, this is unlikely. The Marine Corps TACP course prerequisites state that officers must have a combat arms MOS. If they do not they must receive a waiver from Marine Corps Training and Education Command (TECOM) before they can become a joint tactical air controller (JTAC). TECOM's policy is de facto acknowledgment that MOS backgrounds are a significant factor in successful completion of TACP training. Thus 72XX officers, due to their degree of separation from tactical operations, do not in fact have default

access to TACP training.

Marine Corps training policy further exacerbates the need for fires integration subject matter experts in VMUs. The Marine Aviation Weapons and Tactics Training Program (WTTP) guides all Marine aviation training with a "train the trainer" approach. The WTTP mandates that MAWTS-1 "provide standardized advanced tactical training and certification of unit instructor qualifications that support Marine Aviation Training and Readiness (T&R)."[34] Each aircraft type/model/series (TMS) has a specific T&R that guides individuals through syllabi that result in overall unit combat readiness. Marine squadrons dedicate tremendous resources in preparing a small number of select aviators to attend a bi-annual seven-week crucible of advanced aviation training. Upon graduation students are designated Weapons and Tactics Instructors (WTIs) and are subsequently entrusted with managing their unit's combat training syllabus. MAWTS-1 instructors are universally acknowledged as the "best and brightest" that Marine aviation has to offer. During WTI courses the MAWTS-1 instructor cadre often conducts tactical demonstrations and tactics, techniques, and procedures validation on new equipment. Thus, the recent addition of laser designators on the RQ-7B Shadow UAS garnered great anticipation among the MAWTS-1 instructor cadre.

In theory a RQ-7B Shadow UAS is a tremendous combat multiplier, allowing FACs to sort targets via full motion video and utilize the laser designator to host bombs from strike aircraft. However, VMU WTI candidates are not receiving sufficient unit-level tactical training as evidenced by comments from both MAWTS-1 UAS instructors and air officer department staff. When asked about the progress of Shadow laser designator tactics, a MAWTS-1 UAS instructor stated, "Laser designator operations? At times we don't even trust the UAS crew's fuel

calculations. It's difficult to train higher-end tactics when baseline knowledge is missing."[35] On the receiving end of VMU tactical operations at WTI courses, air officer instructors feel that "There are many promises made [about Shadow CAS capabilities] by VMU leadership that are impossible to back up during WTI events. VMU WTI candidates lack understanding of USMC CAS vernacular, tactics, techniques, and procedures."[36] A current VMU commander stated that he was "not surprised" by the MAWTS-1 instructor feedback.[37] He went on to say that as the commanding officer he gave a two hour "chalk talk" training brief to his squadron prior to the first live fire employment of the Shadow laser designator. Intended to validate tactical employment templates, this occurred during a combat deployment in Operation Enduring Freedom . The commanding officer was a former MAWTS-1 AH-1W Cobra tactics instructor and conducted the training because no one else in the squadron could teach aviation fires integration. Clearly a disconnect exists between the RQ-7B Shadow's potential (advertised) offensive capabilities and its performance during MAWTS-1 operations. Additionally, heroic leadership at the command level is not a valid model for the success or safety of weaponized UAS operations.

The lack of quality fires integration subject matter experts (SMEs) hamstrings VMU offensive operations. At least eight of the twelve officers selected for UAS aircraft commander on the Summer transition board should have level four MOS backgrounds or experience. Each active VMU squadron must have two officers teaching offensive air support T&R training over the next three to five years. VMU squadrons will only realize full potential when provided with aviation fires integration SMEs.

The assignment of strike aviators to KC-130 assault support squadrons demonstrates the

challenges of sourcing personnel with fires integration experience. In the fall of 2010 the Marine Corps deployed its first Harvest Hawk equipped KC-130. The Harvest Hawk kit adds a roll-on / roll-off sensor capability that allows KC-130 crews to fire griffin and hellfire missiles in CAS operations. Harvest Hawk fielding is similar to UAS weaponization, since employment of both systems requires that crews are trained in offensive air support (OAS) operations. Since KC-130 squadrons do not train to OAS missions the Marine Corps issued a call for personnel to augment the KC-130 crews. Nominations for three "Marine pilots or naval flight officers (NFOs) with targeting pod and precision munitions delivery experience" were requested from FMF units. The message stated that the three should have at least two years operational experience.[38] Of the three officers nominated, two were F/A-18 WSOs who fit the criteria. However, the third was a relatively inexperienced AV-8B Harrier pilot. The less experienced pilot introduced friction into a fluid training environment. By ensuring that the Harvest Hawk message contained adequate fires integration precepts, MAWTS-1 hoped to avoid this situation. The MAWTS-1 KC-130 division, in coordination with the tactical aviation department, had drafted a message with stringent fires integration prerequisites. The message was forwarded to headquarters where the MAWTS-1 prerequisites were diluted.[39] Ostensibly the prerequisites were "reduced" in order to provide a larger pool of draftees. The nascent success of the Harvest Hawk combat deployment is a testament to the "improvise, adapt, overcome" Marine ethos. But lackadaisical personnel assignment policies do no favors for individual career progression or combined arms synergy. The Marine Corps cannot afford today's status quo with 84% of its UAS aircraft commanders lacking OAS credibility. If manning KC-130s with only three strike aviators was difficult, where can the Corps expect to find enough level four integrators to

fill VMU aircraft commander billets?

F/A-18 weapon system operators (WSO) are the most obvious choice for transition to UAS aircraft commander. Although not rated pilots, WSOs offer many parallels to the role that Air Force navigators play in Predator and Reaper squadrons. They have the appropriate MOS background, and providing normal career progression they should be qualified FAC(A)s by seven years continuous service (YCS). By default a mid to senior grade captain or junior major WSO is a level four fires integrator. Perception in the FMF seems to be that WSO are "jumping ship" to special education program (SEP) assignments resulting in an WSO shortage in fleet squadrons.[40] Figure 5 depicts WSO billet assignments as of May 2010 and shows only seven WSOs in SEP billets. Fleet F/A-18 squadrons have all of the WSOs they need from headquarters manpower management perspective (see Figure 6). As of 4 May, 2010 89 of 90 fleet WSO billets were filled. Individual augments and other fleet staffing requirements left the three active duty F/A-18 marine air groups short only three WSOs in aggregate. Such shortages are caused by wartime individual augment assignments and other staffing requirements. In total the Marine Corps is at 104% and 128% of grade adjusted recapitulation (GAR) for WSO captains and majors respectively.[41] There are very few excess WSOs at the rank of captain, while WSO majors are in greater supply. When overseas contingency operations end WSO shortages will disappear. Furthermore, when the first F/A-18D squadron transitions to the F-35B in fiscal year 2014 (FY 14) WSO availability increases. The FY 14 transition date is based upon the Marine Corps FY 11 Marine Aviation Plan and does not include the two-year F-35B "probation" period. The Marine F-35B will now be the last, not the first F-35 model to enter service.[42] Despite the potential future availability of WSOs, the Marine Corps will begin UAS officer transitions in the summer of

2011. The need to source level four fires integrators to VMU squadrons cannot wait until FY 14-16 or later.

The Marine Corps position regarding VMU officer manning is complicated by an additional factor: the venerable CH-46 helicopter is ending service. A large population of captain and major assault support officers no longer have a primary military occupational specialty (MOS) job. The December MOS status report shows that the CH-46 pilot population is at 99% of GAR for captains and 184% of GAR for majors.[43] CH-46 "sundown" offers a large population of pilots without a primary MOS. Unless these assault support pilots have level four fires integration experience they should not be considered for transition to UAS aircraft commanders in the summer of 2011. With a large population of pilots available for transition but stringent fires integration requirements, what methods can the Marine Corps use to ensure that only level four integrators transition to VMU service? The next section attempts to answer this question by offering suggestions categorized by low, medium, and high impact to Marine VMU operations and overall Marine Corps manpower management.

Immediate Actions

Sufficient numbers of highly skilled fires integrators exist to fill the Summer 2011 UAS aircraft commander transition board requirement. The question is: will fires integration requirements be diluted as occurred in the Harvest Hawk fielding? Or will the Marine Corps take General Fogleman's "If this program fails, it won't be because of our pilots" mantra to heart? As discussed earlier, the Air Force experienced improved volunteer rates, retention rates, and morale after awarding aviation career incentive pay to rated pilots serving in UAS squadrons. The Marine Corps should take this experience into account and offer aviation

continuation pay (ACP) to UAS aircraft commanders. The intent of ACP is to "provide a proactive long-term aviation career incentive for Marine aviation officers."[44] As civilian application of UAS technology expands the Marine Corps may find that it needs to offer UAS operators a bonus larger than manned platforms require. In the near term UAS aircraft commanders will have manned aviation backgrounds. It is imperative that UAS aircraft commanders receive ACP on par with manned strike platforms.

Low Impact

The Summer 2011 transition board will establish the initial VMU fires integration cadre. Subsequent transition boards require precepts to ensure uniform fires knowledge in VMU squadrons. Future UAS aircraft commander boards must include a precept mandating that all applicants possess the 7502 FAC MOS. 72XX officers will thus be ineligible for transition to unmanned aircraft commander (UAC). Such a move constitutes a break with traditional VMU officer manning protocol. The Air Force broke with its traditional UAS manpower models when it transitioned to kinetic UAS operations. The rapid evolution of UAS into offensive battlefield operations requires the Marine Corps do the same. 72XX officers made reputable contributions to UAS operations when passive observation constituted the "level of effort" VMU mission. With the advent of weaponized UAS all VMU leaders must have an aviation fires integration background. Finally, future UAS aircraft commander boards should ensure that approximately ten percent of officers selected have a strike or EW MOS background. VMU squadrons must be occasionally seeded with personnel who can immediately serve as fires integration subject matter experts (SMEs) with little or no "spin up" time. They will replace the level four fires integration SMEs selected in the Summer 2011 transition board as the initial selectees move

out of fleet squadrons.

Medium Impact

Timing of the first UAS aircraft commander primary MOS transition board is not optimal. Marine culture values weapon systems that produce kinetic effects over non-kinetic effects. Although the RQ-7B Shadow will eventually possess kinetic weapons, it does not at present. Nor has the Marine Corps yet purchased its Group 4 weaponized UAS system. Thus, Marines in general have not experienced the Air Force's weaponized UAS revolution. Marines will appreciate VMU squadrons to a far greater degree once UAS deliver kinetic fires to the Marine air ground task force (MAGTF). The first UAS aircraft commander transition board could be delayed until the Marine Corps fields a weaponized shadow variant. Delaying the first transition board insures that strike aviators with level four fires experience are attracted to service in VMU squadrons. Delaying the transition board prioritizes fires integration SMEs above the immediate need for consistent VMU officer leadership. As such it is unlikely that the first transition board will be delayed. If the board progresses as scheduled Marine leaders must not compromise on the precepts outlined above.

High Impact

The Marine Corps may need to involuntarily assign the UAS aircraft commander MOS to a small number of aviators. Such drastic measures may be required based upon Marine Corps transition board policy, the poor state of initial UAS aircraft commander training, and lack of fires SMEs in UAS squadrons. Marine Corps transition boards in general tend to minimize precepts to ensure sufficient numbers of volunteers.[45] A "cast the net widely" mentality is based on the assumption that quality does not matter if stringent precepts restrict qualified

applicants to a small number. The MAWTS-1 Harvest Hawk message was diluted because of this [informal] policy. Traditional MOS transition boards can minimize precepts because a robust training pipeline supports every other aviation community. For example, if an AH-1W pilot transitions to the AV-8B Harrier he attends AV-8B flight training conducted by Marine Harrier pilots. Tactical operations including CAS are introduced. Once he arrives at his fleet squadron he progresses through the T&R with weapons and tactics instructors who are experts in all aspects of AV-8B tactical employment. In contrast, Marine UAS training is outsourced to the Army. The Army further outsources training to a contractor. The result is that personnel who have never been UAS commanders and have never served in a VMU teach this three week-long UAS aircraft commander course.[46] The quality of instruction is so poor that one VMU operations officer wrote a Marine Corps Gazette article that states "The way the course runs now we might as well hand the students a disc full of Microsoft PowerPoint slides and give the instructors 3 weeks of paid leave."[47] No off-site "field" training is conducted, and the laser designator is not utilized because the UAS training base is not co-located with a laser safe training range. If Shadow is weaponized it is unlikely that ordnance will be employed during familiarization training. The traditional "cast the net widely" and we'll fix it with training mentality does not apply to VMU squadrons. The Marine Corps has more excess majors than captains in all of its aviation platforms, to include the strike community. If mid-level majors with level four fires integration experience are considered for involuntary assignment this course of action is plausible. As the Air Force discussion indicates, Marine leaders should consider the retention and morale of involuntarily assigned aviators. The Marine Corps can make involuntary assignment to the UAS mission commander MOS more palatable by offering an initial bonus of

$25,000 to $50,000 upon completion of MOS training.[48] Furthermore, WSOs assigned to UAS squadrons may have the ability to serve as mission coordinators in B-billet tours with F-35B Joint Strike Fighter squadrons.[49] The possibility of serving in an F-35B squadron may placate concerns that UAC assignment is a permanent departure from manned squadron culture.

Conclusion

Marine UAS operations are on the verge of following the Air Force from intelligence-driven, passive imagery collection to intelligence and operations-driven offensive air support. Establishing a fires-centric culture sets conditions for the future success of weaponized UAS. The foundation of weaponized UAS culture is the aviator with level four fires experience. The Air Force assigns aviation SMEs who understand how UAS fit into Air Force offensive air support doctrine. The Air Force's nine-year long history of weaponized UAS operations offers several considerations regarding UAS manpower policy. Air Force UAS operations indicate that weighting UAS squadrons with pilots from strike backgrounds facilitates the transition to offensive air support operations. Pilots assigned to UAS squadrons require ACP in order to maintain morale and retention rates. Marines in combat need level four integrators in VMU squadrons to prevent fratricide and put bombs on target on time. VMU squadrons must not stumble during their offensive air support transition. VMUs must live up to the synergy that weaponized persistent stare capabilities offer the MAGTF. Marine combined arms operations may suffer for years if the initial "roll-out" of weaponized UAS follows the path of VMU laser designator operations. Officers set the conditions for success (command), staff NCOs supervise, and NCOs get the work done. Selecting aviators with level four fires integration experience on the summer 2011 UAC transition board will set the conditions for Marine VMUs to progress

from good to great. Subsequent UAC transition boards must select only officers with FAC training. The Marine Corps can no longer afford to dilute its VMU fires culture. Marines emphasize the importance of leadership. Ensuring that appropriate leaders are placed in VMU squadrons is a quick, inexpensive way to ensure success during this time of change in VMU operations. Weaponized Marine UAS will induce friction in combined arms operations unless supervised by officers with an understanding of Marine aviation fires doctrine. With great opportunity comes great responsibility.

Appendix A: Illustrations

UAS Category	Maximum Gross Takeoff Weight (lbs)	Normal Operating Altitude (ft)	Speed (KIAS)	Current/Future Representative UAS
Group 1	0-20	< 1,200 AGL	100 kts	WASP III, Future Combat System Class I, TACMAV RQ-14A/B, BUSTER, BATCAM, RQ-11B/C, FPASS, RQ-16A, Pointer, Aqua/Terra Puma
Group 2	21-55	< 3,500 AGL	< 250 kts	Vehicle Craft Unmanned Aircraft System, ScanEagle, Silver Fox, Aerosonde
Group 3	< 1,320	< 18,000 MSL		RQ-7B, RQ-15, STUAS, XPV-1, XPV-2
Group 4	> 1,320		Any Airspeed	MQ-5B, MQ-8B, MQ-1A/B/C, A-160
Group 5		> 18,000 MSL		MQ-9A, RQ-4, RQ-4N, Global Observer, N-UCAS

Note: Lighter than air vehicles will be categorized by the highest level of any of their operating criteria.

(1) Group 1 UA: Typically weighs less than 20 pounds and normally operates below 1200 feet AGL at speeds less than 250 knots.

(2) Group 2 UA: Typically weighs 21-55 pounds and normally operates below 3500 feet AGL at speeds less than 250 knots.

(3) Group 3 UA: Typically weighs more than 55 pounds but less than 1320 pounds and normally operates below 18,000 feet MSL at speeds less than 250 knots.

(4) Group 4 UA: Typically weighs more than 1320 pounds and normally operates below 18,000 feet MSL at any speed.

(5) Group 5 UA: Typically weighs more than 1320 pounds and normally operates higher than 18,000 feet MSL at any speed.

Figure 1. UAS Categories, Joint UAS Center of Excellence

Occfield	O-2	O-3	O-4	O-5
72XX officers	2.4	5.0	10.5	18.5
(n-size)	(6)	(8)	(13)	(2)
75XX officers	2.6	6.5	11.8	18.5
(n-size)	(5)	(39)	(16)	(12)

Figure 2- Average years of commissioned service at time of arrival to the VMU by occupational field and paygrade.

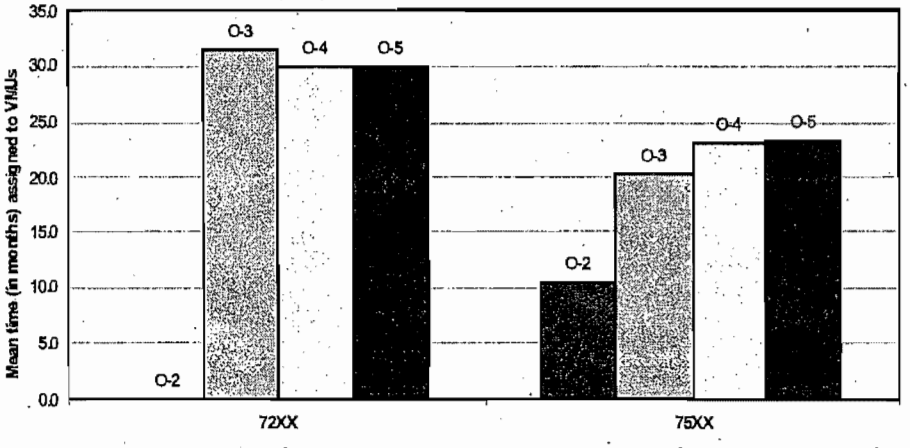

Figure 3- Average length of VMU assignments since 1996 by occupational field.[50]

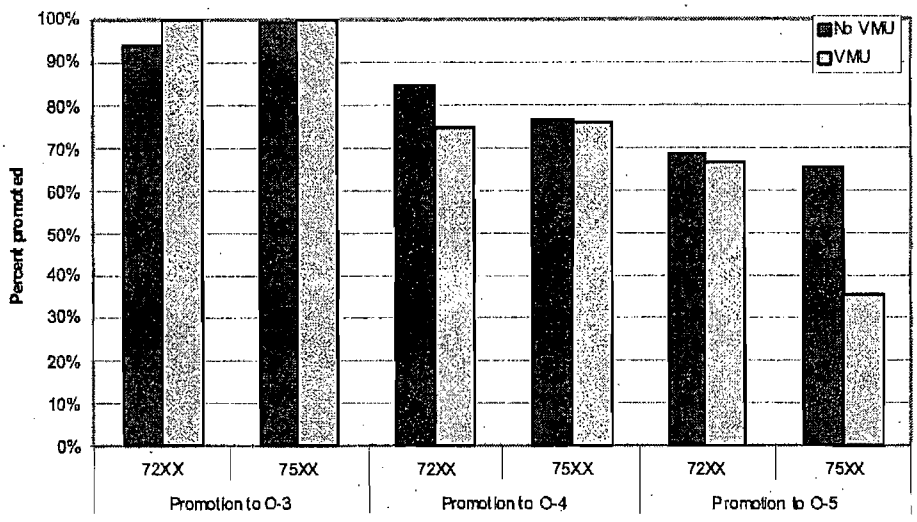

Figure 4- Percent promoted first time in zone for grade when board convenes after VMU assignment by 72XX and 75XX occupational fields. (Source Manpower Analysis for Unmanned Aerial Systems, CNA, June 2009)

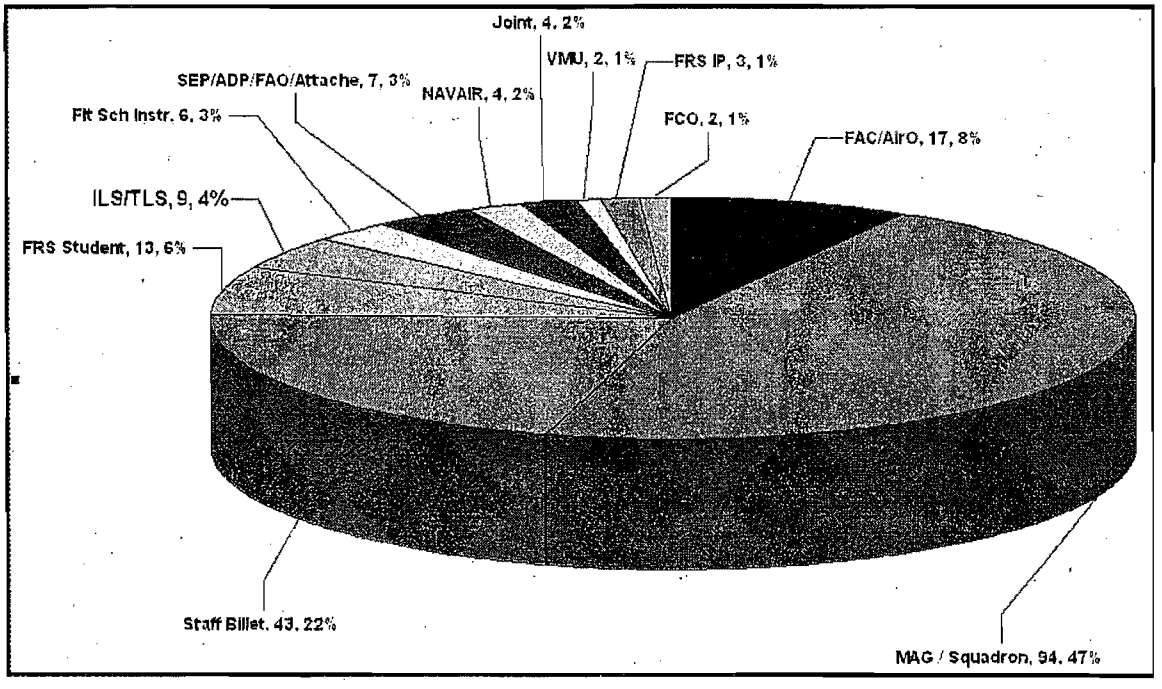

Figure 5- F/A-18 WSO distribution as of 4 May 2010. (Source HQMC Marine Air Board 3-10)

MCC	Location	UNIT	T/O	MSR	7523	SG	OB	1-Oct	Delta
1JA	MIRAMAR	MAG 11	0	0	6	0	1	0	6
V6A	MIRAMAR	VMFA(AW)-121	19	15	-	15	14	15	0
VFG	MIRAMAR	VMFA(AW)-225	19	17	-	17	15	17	0
1T6	MIRAMAR	VMFAT-101	5	5	-	5	3	5	0
			43	**37**	**6**	**37**	**33**	**37**	**6**
1JJ	BEAUFORT	MAG-31	0	0	1	0	0	0	1
V61	BEAUFORT	VMFA(AW)-224	19	19	-	18	20	18	1
V63	BEAUFORT	VMFA(AW)-533	19	18	-	18	20	18	0
			38	**37**	**1**	**36**	**40**	**36**	**0**
1JB	IWAKUNI	MAG 12	0	0	2	0	1	3	5
V6B	IWAKUNI	VMFA(AW)-242	19	17	-	16	20	16	1
			19	**17**	**2**	**16**	**21**	**19**	**4**
			100	**91**	**9**	**89**	**94**	**92**	**10**

Figure 6- WSO Staffing as of 4 May, 2010. Source LtCol Craig Wirth, HQMC ASM.
*SG= Staffing Goal, OB= On Board in Unit

Endnotes

[1] Terminology referencing Unmanned Systems evolved from "drones" in the early evolution of these systems. Later they were referred to as remotely piloted aircraft (RPA) and then as aerial vehicles (UAV). The Air Force recently re-adopted the RPA terminology. This paper will use the today's universally accepted term UAS to refer to unmanned aircraft and related ground support systems. Unmanned aircraft (UA) will be reserved for reference solely to the air vehicle itself.

[2] Houston R. Cantwell, "Beyond Butterflies: Predator and the Evolution of Unmanned Aerial Vehicle in Air Force Culture," (master's thesis, School of Advanced Air and Space Studies, 2007), 26, http://

[3] Patrick Sullivan and David M. Church, "The Unmanned Aircraft Systems Training Battalion: growing and transforming to meet the Voracious Demand for UAS capability." *Army Aviation*, November 30, 2010, 40.

[4] Headquarters U.S. Air Force, *Unmanned Aircraft Systems Flight Plan 2009-2047,* (Washington, DC: U.S. Air Force, May 18, 2009), 28.

[5] USAF UAS Flight Plan, 28.

[6] The first study is *Manpower Alternatives for Unmanned Aerial* Systems completed by the Center for Naval Analysis (CNA) in June 2009. The CNA study provided background information that supported the Deputy Commandant for Aviation's (DCA) May 2010 decision to create a new primary military occupational specialty for unmanned aircraft commanders. The second study is the *UNMANNED AIRCRAFT COMMANDER (UAC): PRIMARY MILITARY OCCUPATIONAL SPECIALTY (PMOS) PROGRAM OF INSTRUCTION (POI) STUDY* completed by Northrop Grumman Information Systems, Fairfax, VA. on 30 April 2010. Phase two of the second study is in progress and is intended to refine the training requirements and manpower phase-in plan for UAC.

[7] Cantwell, 81.

[8] James C. Dawkins, Lt Col, USAF, "Unmanned Combat Aerial Vehicles: Examining the Political, Moral, and Social Implications," (master's thesis, School of Advanced Air and Space Studies, Air University, Maxwell Air Force Base, AL, 2005), 42.

[9] Carl H. Builder, *The Masks of War*, (Baltimore, MD: The Johns Hopkins Univ. Press, 1989), 23.

[10] Cantwell, 21.

[11] Thomas Ehrhard, "Unmanned Aerial Vehicles in the United States Armed Services: A Comparative Study of Weapon System Innovation," (Ph.D. Diss., The Johns Hopkins University, 2001), 593.

[12] Cantwell, 93.

[13] LtCol Houston R. Cantwell interview. In addition, a 2006 survey found that 50-60% of UAS pilots poled wanted to remain in the community.

[14] Cantwell, 79.

[15] Cantwell, 88.

[16] Canwell, 88.

[17] Cantwell, 89.

[18] Cantwell, 90.

[19] USAF UAS Flight Plan, 28.

[20] The requirements are as follows: Pilots (~1650), Sensor Operators (SO) (~1440), Mission Intel Coordinators (~900), processing, analysis, and dissemination (PAD) (~5300), Maintainers (~5500), and small UAS Operators (Groups 1-3) (~680), USAF UAS Flight Plan, 28.

[21] USAF UAS Flight Plan, 28.

[22] USAF UAS Flight Plan, 30.

[23] USAF UAS Flight Plan, 80.

[24] Joseph Bertagna, "UAS: It's Time to Get Serious," *Marine Corps Gazette*, (September, 2010): 39.

[25] Bertagna, 39.

[26] Northrop Grumman Information Systems and David Moore, *Unmanned Aircraft Commander (UAC): Primary Military Occupational Specialty (PMOS) Program of Instruction (POI) Study*, (Fairfax, VA: Northrop Grumman Information Systems, 2010), 4-2.

[27] Hereafter AH-1, UH-1, AV-8B and F/A-18 communities are referred to collectively as the "strike" community.

[28] The Marine Corps Weapons and Tactics Instructor (WTI) training course imparts "graduate level" fires knowledge on tactical air pilots. An EA-6B WTI graduate would thus be more knowledgeable about close air support operations, but would still not have any practical application experience.

[29] Michelle Dolfini-Reed and others, *Manpower Alternatives for Unmanned Aerial Systems,* (Alexandria, VA: Center for Naval Analysis, 2009), 41.

[30] Craig Wirth and others, "Deputy Commandant for Aviation Unmanned Aircraft Commander Primary MOS Decision Brief," (Headquarters U.S. Marine Corps, July 2010), slide 13.

[31] Headquarters U.S. Marine Corps, *Fire Support in the Ground Combat Element,* (Washington, DC: U.S. Marine Corps, November, 28, 2001), 1-2.

[32] Robert R. Blackman, "Fixing Fire Support in the GCE." *Field Artillery* March-April, 2001, 25.

[33] Interview, Captain Victor, 4 February, 2011.

[34] Commandant of the Marine Corps. *Marine Corps Aviation and Weapons Training Program*, MCO 3500.109, January 16, 2007, paragraph 2.

[35] Major Chris Coble, telephone interview with author, 14 Jan 2011.

[36] Major Brian Erbecker, telephone conversation with author, 16 Feb, 2011.

[37] LtCol John Barranco, VMU-1 Commanding Officer, telephone interview with author, March 15, 2011.

[38] Naval Message **DTG: 191428Z May 09** /GENADMIN/CG TECOM ATB// SUBJ/FIRE CONTROL OPERATOR (FCO) STAFFING FOR THE RAPID FIELDING OF THE KC-130J HARVEST HAWK MISSION KIT

[39] Major Pope, MAWTS-1 KC-130 division head, telephone conversation with author, 14 Jan 2011.

[40] Erbecker Interview.

[41] Captain Charles Ferrer, email message to author: November, FY 2011 MOS staffing report, 10 December, 2011.

[42] John T. Bennett, "Pentagon Kills EFV, Puts F-35B on Probation, *Defense News*, January 6, 2011, http://www.defensenews.com/story.php?i=5394171 (accessed February 11, 2011).

[43] Major Robert Fanning, email message to author, 22 March, 2011.

[44] Commandant of the Marine Corps, Fiscal Year 2011 Aviation Continuation Pay, MCBul 7220, February 17, 2011, http://www.marines.mil/news/messages/Pages/MARADMIN117-11.aspx (accessed 11 March, 2011).

[45] TECOM curriculum development officer, telephone conversation with author, 20 Dec 2010.

[46] Bertagna, 39.

[47] Bertagna, 39.

[48] This more than doubles the strike community ACP for FY-11, which is $10,000.

[49] Colonel Ross L. Roberts, "The F-35B WSO: Take Care of Our Own: Don't Leave Them Hanging," *Marine Corps Gazette*, (May 2009): 33.

[50] CNA Manpower Alternatives, 44.

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